

# MMSZ5221ET1 Series

Preferred Device

## Zener Voltage Regulators

### 500 mW SOD-123 Surface Mount

Three complete series of Zener diodes are offered in the convenient, surface mount plastic SOD-123 package. These devices provide a convenient alternative to the leadless 34-package style.

#### Features

- 500 mW Rating on FR-4 or FR-5 Board
- Wide Zener Reverse Voltage Range – 2.4 V to 110 V
- Package Designed for Optimal Automated Board Assembly
- Small Package Size for High Density Applications
- General Purpose, Medium Current
- ESD Rating of Class 3 (>16 kV) per Human Body Model
- Peak Power – 225 W (8 x 20  $\mu$ s)
- Pb-Free Packages are Available

#### Mechanical Characteristics:

**CASE:** Void-free, transfer-molded, thermosetting plastic case

**FINISH:** Corrosion resistant finish, easily solderable

**MAXIMUM CASE TEMPERATURE FOR SOLDERING PURPOSES:**

260°C for 10 Seconds

**POLARITY:** Cathode indicated by polarity band

**FLAMMABILITY RATING:** UL 94 V-0

#### MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Peak Power Dissipation @ 20 $\mu$ s (Note 1) @ $T_L \leq 25^\circ\text{C}$	$P_{pk}$	225	W
Total Power Dissipation on FR-5 Board, (Note 3) @ $T_L = 75^\circ\text{C}$ Derated above 75°C	$P_D$	500 6.7	mW mW/°C
Thermal Resistance, (Note 2) Junction-to-Ambient	$R_{\theta JA}$	340	°C/W
Thermal Resistance, (Note 2) Junction-to-Lead	$R_{\theta JL}$	150	°C/W
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	°C

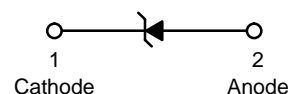
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Nonrepetitive current pulse per Figure 11.
2. Thermal Resistance measurement obtained via infrared Scan Method.
3. FR-5 = 3.5 x 1.5 inches, using the minimum recommended footprint.



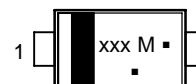
ON Semiconductor®

<http://onsemi.com>



SOD-123  
CASE 425  
STYLE 1

#### MARKING DIAGRAM



xxx = Device Code (Refer to page 2)

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

Device	Package	Shipping†
MMSZ52xxET1	SOD-123	3000/Tape & Reel
MMSZ52xxET1G	SOD-123 (Pb-Free)	3000/Tape & Reel
MMSZ52xxET3	SOD-123	10000/Tape & Reel
MMSZ52xxET3G	SOD-123 (Pb-Free)	10000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

#### DEVICE MARKING INFORMATION

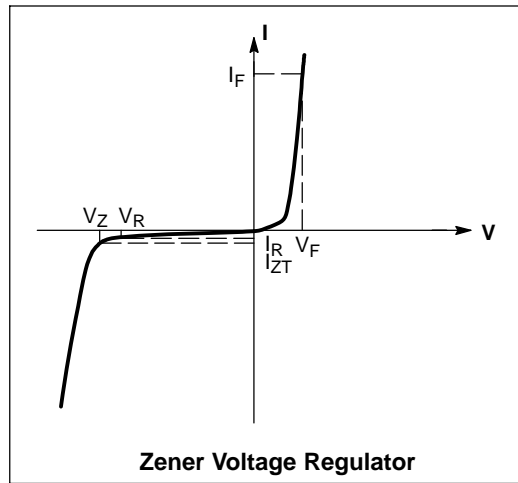
See specific marking information in the device marking column of the Electrical Characteristics table on page 2 of this data sheet.

Devices listed in **bold, italic** are ON Semiconductor Preferred devices. Preferred devices are recommended choices for future use and best overall value.

## MMSZ5221ET1 Series

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted,  $V_F = 0.95\text{ V Max. @ } I_F = 10\text{ mA}$ )

Symbol	Parameter
$V_Z$	Reverse Zener Voltage @ $I_{ZT}$
$I_{ZT}$	Reverse Current
$Z_{ZT}$	Maximum Zener Impedance @ $I_{ZT}$
$I_{ZK}$	Reverse Current
$Z_{ZK}$	Maximum Zener Impedance @ $I_{ZK}$
$I_R$	Reverse Leakage Current @ $V_R$
$V_R$	Reverse Voltage
$I_F$	Forward Current
$V_F$	Forward Voltage @ $I_F$



**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted,  $V_F = 0.9\text{ V Max. @ } I_F = 10\text{ mA}$ )

Device*	Device Marking	Zener Voltage (Notes 4 and 5)				Zener Impedance (Note 6)			Leakage Current	
		$V_Z$ (V)			@ $I_{ZT}$	$Z_{ZT}$ @ $I_{ZT}$	$Z_{ZK}$ @ $I_{ZK}$		$I_R$ @ $V_R$	
		Min	Nom	Max	mA	$\Omega$	$\Omega$	mA	$\mu\text{A}$	V
<b>MMSZ5221ET1</b>	<b>CA1</b>	<b>2.28</b>	<b>2.4</b>	<b>2.52</b>	<b>20</b>	<b>30</b>	<b>1200</b>	<b>0.25</b>	<b>100</b>	<b>1</b>
<b>MMSZ5223ET1</b>	<b>CA3</b>	<b>2.57</b>	<b>2.7</b>	<b>2.84</b>	<b>20</b>	<b>30</b>	<b>1300</b>	<b>0.25</b>	<b>75</b>	<b>1</b>
MMSZ5226ET1	CA6	3.14	3.3	3.47	20	28	1600	0.25	25	1
MMSZ5228ET1	CA8	3.71	3.9	4.10	20	23	1900	0.25	10	1
<b>MMSZ5229ET1</b>	<b>CA9</b>	<b>4.09</b>	<b>4.3</b>	<b>4.52</b>	<b>20</b>	<b>22</b>	<b>2000</b>	<b>0.25</b>	<b>5</b>	<b>1</b>
<b>MMSZ5231ET1</b>	<b>CB2</b>	<b>4.85</b>	<b>5.1</b>	<b>5.36</b>	<b>20</b>	<b>17</b>	<b>1600</b>	<b>0.25</b>	<b>5</b>	<b>2</b>
<b>MMSZ5232ET1</b>	<b>CB3</b>	<b>5.32</b>	<b>5.6</b>	<b>5.88</b>	<b>20</b>	<b>11</b>	<b>1600</b>	<b>0.25</b>	<b>5</b>	<b>3</b>
<b>MMSZ5234ET1</b>	<b>CB5</b>	<b>5.89</b>	<b>6.2</b>	<b>6.51</b>	<b>20</b>	<b>7</b>	<b>1000</b>	<b>0.25</b>	<b>5</b>	<b>4</b>
MMSZ5235ET1	CB6	6.46	6.8	7.14	20	5	750	0.25	3	5
MMSZ5236ET1	CB7	7.13	7.5	7.88	20	6	500	0.25	3	6
MMSZ5237ET1	CB8	7.79	8.2	8.61	20	8	500	0.25	3	6.5
<b>MMSZ5240ET1</b>	<b>CC2</b>	<b>9.50</b>	<b>10</b>	<b>10.50</b>	<b>20</b>	<b>17</b>	<b>600</b>	<b>0.25</b>	<b>3</b>	<b>8</b>
<b>MMSZ5242ET1</b>	<b>CC4</b>	<b>11.40</b>	<b>12</b>	<b>12.60</b>	<b>20</b>	<b>30</b>	<b>600</b>	<b>0.25</b>	<b>1</b>	<b>9.1</b>
MMSZ5243ET1	CC5	12.35	13	13.65	9.5	13	600	0.25	0.5	9.9
MMSZ5244ET1	CC6	13.30	14	14.70	9.0	15	600	0.25	0.1	10
<b>MMSZ5245ET1</b>	<b>CC7</b>	<b>14.25</b>	<b>15</b>	<b>15.75</b>	<b>8.5</b>	<b>16</b>	<b>600</b>	<b>0.25</b>	<b>0.1</b>	<b>11</b>
<b>MMSZ5246ET1</b>	<b>CC8</b>	<b>15.20</b>	<b>16</b>	<b>16.80</b>	<b>7.8</b>	<b>17</b>	<b>600</b>	<b>0.25</b>	<b>0.1</b>	<b>12</b>
<b>MMSZ5248ET1</b>	<b>CD1</b>	<b>17.10</b>	<b>18</b>	<b>18.90</b>	<b>7.0</b>	<b>21</b>	<b>600</b>	<b>0.25</b>	<b>0.1</b>	<b>14</b>
MMSZ5250ET1	CD3	19.00	20	21.00	6.2	25	600	0.25	0.1	15
<b>MMSZ5252ET1</b>	<b>CD5</b>	<b>22.80</b>	<b>24</b>	<b>25.20</b>	<b>5.2</b>	<b>33</b>	<b>600</b>	<b>0.25</b>	<b>0.1</b>	<b>18</b>

4. The type numbers shown have a standard tolerance of  $\pm 5\%$  on the nominal Zener voltage.
5. Nominal Zener voltage is measured with the device junction in thermal equilibrium at  $T_L = 30^\circ\text{C} \pm 1^\circ\text{C}$ .
6.  $Z_{ZT}$  and  $Z_{ZK}$  are measured by dividing the AC voltage drop across the device by the ac current applied. The specified limits are for  $I_{Z(AC)} = 0.1 I_{Z(dc)}$  with the AC frequency = 1 kHz.

\*The "G" suffix indicates Pb-Free package available. See Ordering Information Table on page 1.

## MMSZ5221ET1 Series

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted,  $V_F = 0.9\text{ V Max.}$  @  $I_F = 10\text{ mA}$ )

Device*	Device Marking	Zener Voltage (Notes 4 and 5)			Zener Impedance (Note 6)			Leakage Current		
		$V_Z$ (V)			@ $I_{ZT}$	$Z_{ZT}$ @ $I_{ZT}$	$Z_{ZK}$ @ $I_{ZK}$		$I_R$ @ $V_R$	
		Min	Nom	Max	mA	$\Omega$	$\Omega$	mA	$\mu\text{A}$	V
MMSZ5253ET1	CD6	23.75	25	26.25	5.0	35	600	0.25	0.1	19
MMSZ5254ET1	CD7	25.65	27	28.35	4.6	41	600	0.25	0.1	21
MMSZ5255ET1	CD8	26.60	28	29.40	4.5	44	600	0.25	0.1	21
MMSZ5256ET1	CD9	28.50	30	31.50	4.2	49	600	0.25	0.1	23
MMSZ5257ET1	CE1	31.35	33	34.65	3.8	58	700	0.25	0.1	25
MMSZ5258ET1	CE2	34.20	36	37.80	3.4	70	700	0.25	0.1	27
MMSZ5259ET1	CE3	37.05	39	40.95	3.2	80	800	0.25	0.1	30
MMSZ5262ET1	CE6	48.45	51	53.55	2.5	125	1100	0.25	0.1	39
MMSZ5263ET1	CE7	53.20	56	58.80	2.2	150	1300	0.25	0.1	43

4. The type numbers shown have a standard tolerance of  $\pm 5\%$  on the nominal Zener voltage.

5. Nominal Zener voltage is measured with the device junction in thermal equilibrium at  $T_L = 30^\circ\text{C} \pm 1^\circ\text{C}$ .

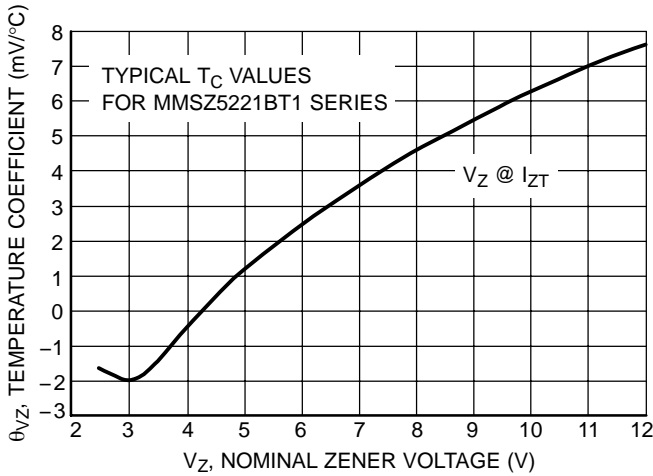
6.  $Z_{ZT}$  and  $Z_{ZK}$  are measured by dividing the AC voltage drop across the device by the ac current applied.

The specified limits are for  $I_{Z(AC)} = 0.1 I_{Z(dc)}$  with the AC frequency = 1 kHz.

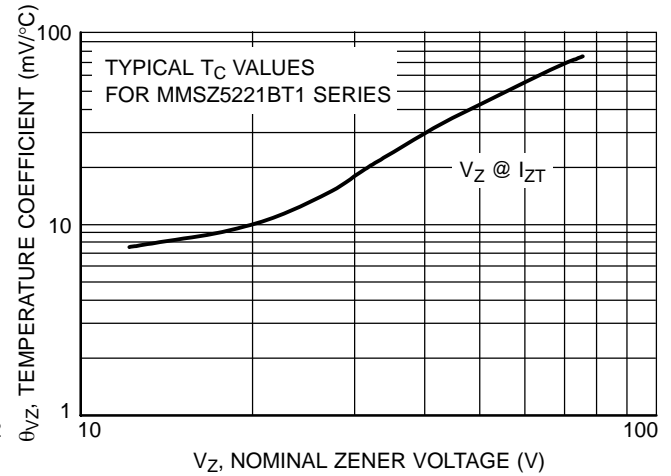
\*The "G" suffix indicates Pb-Free package available. See Ordering Information Table on page 1.

# MMSZ5221ET1 Series

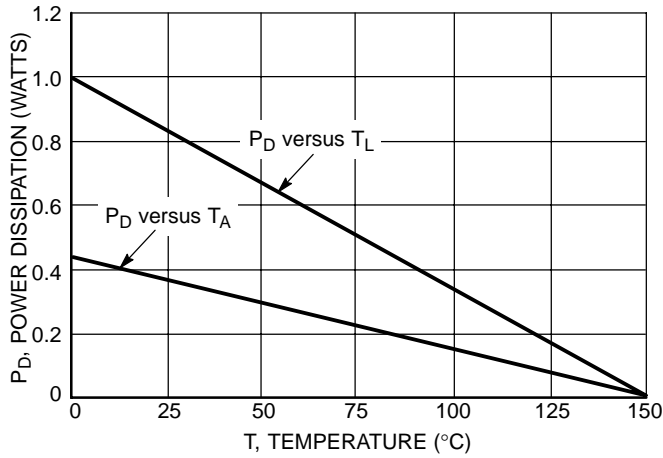
## TYPICAL CHARACTERISTICS



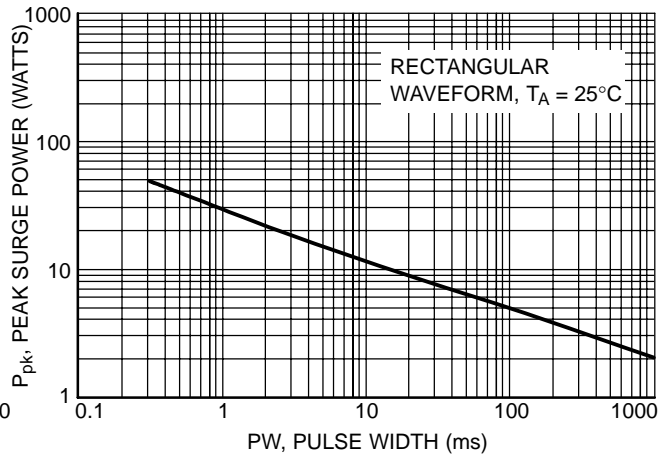
**Figure 1. Temperature Coefficients (Temperature Range -55°C to +150°C)**



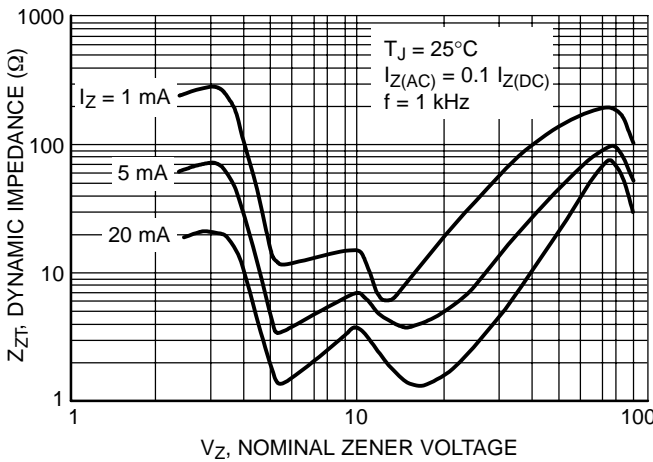
**Figure 2. Temperature Coefficients (Temperature Range -55°C to +150°C)**



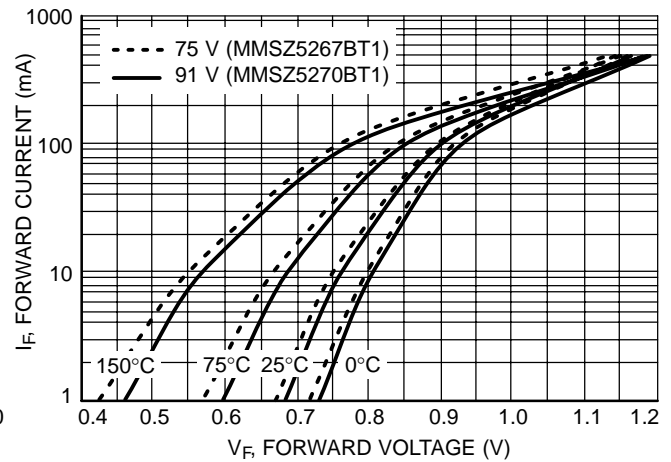
**Figure 3. Steady State Power Derating**



**Figure 4. Maximum Nonrepetitive Surge Power**



**Figure 5. Effect of Zener Voltage on Zener Impedance**



**Figure 6. Typical Forward Voltage**

# MMSZ5221ET1 Series

## TYPICAL CHARACTERISTICS

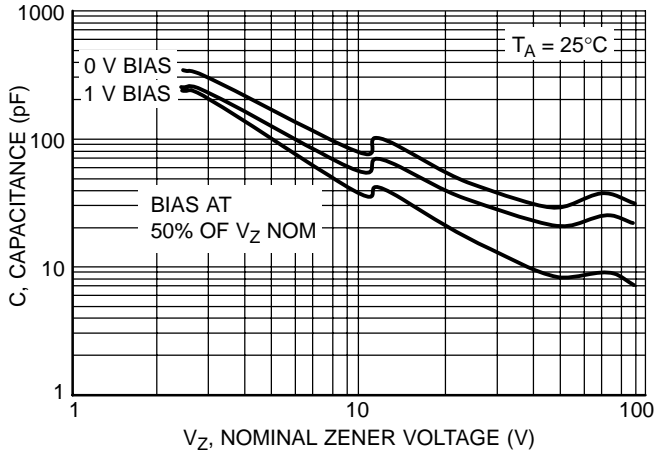


Figure 7. Typical Capacitance

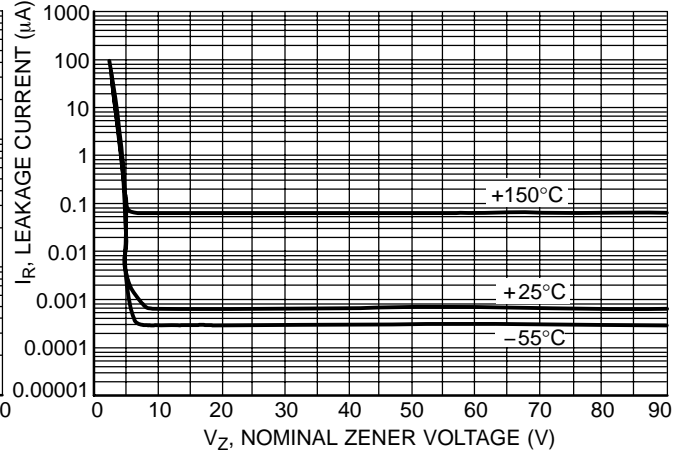


Figure 8. Typical Leakage Current

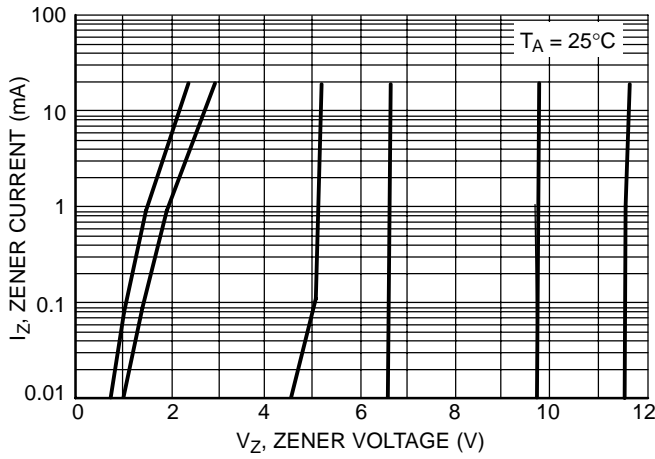


Figure 9. Zener Voltage versus Zener Current (V<sub>Z</sub> Up to 12 V)

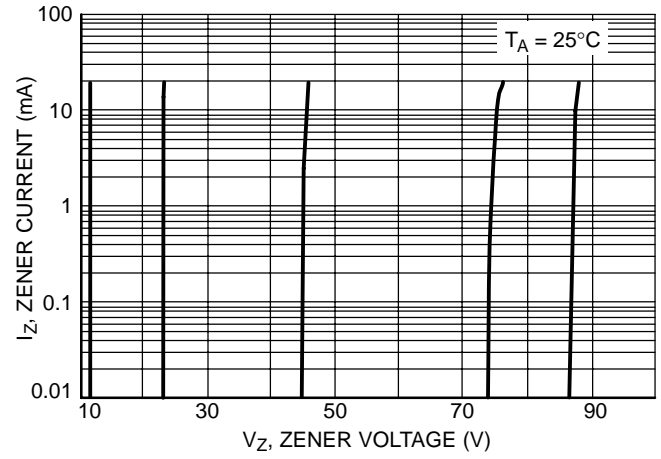


Figure 10. Zener Voltage versus Zener Current (12 V to 91 V)

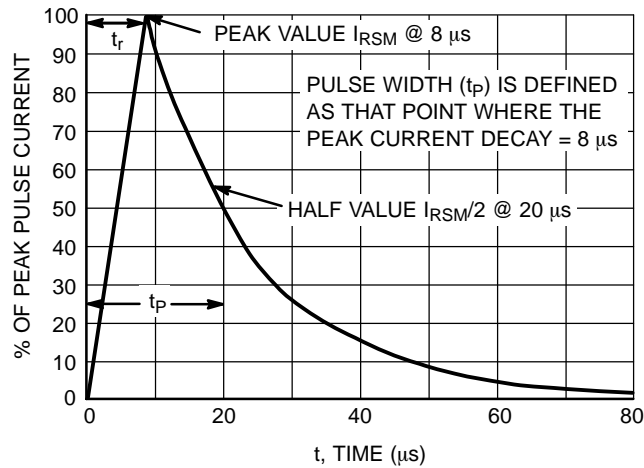
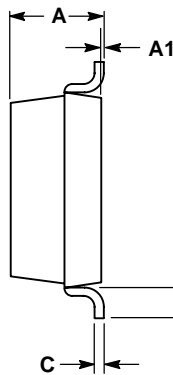
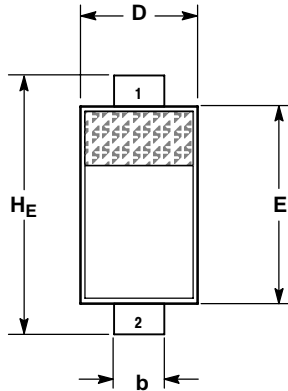


Figure 11. 8 × 20 μs Pulse Waveform

# MMSZ5221ET1 Series

## PACKAGE DIMENSIONS

SOD-123  
CASE 425-04  
ISSUE E



NOTES:

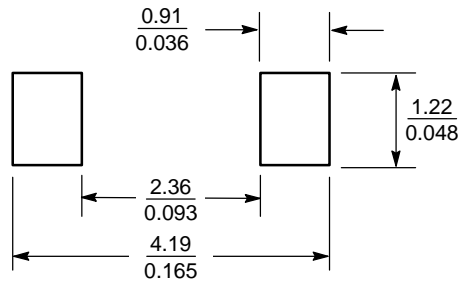
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.94	1.17	1.35	0.037	0.046	0.053
A1	0.00	0.05	0.10	0.000	0.002	0.004
b	0.51	0.61	0.71	0.020	0.024	0.028
c	---	---	0.15	---	---	0.006
D	1.40	1.60	1.80	0.055	0.063	0.071
E	2.54	2.69	2.84	0.100	0.106	0.112
HE	3.56	3.68	3.86	0.140	0.145	0.152
L	0.25	---	---	0.010	---	---

STYLE 1:

- PIN 1. CATHODE
- PIN 2. ANODE

### SOLDERING FOOTPRINT\*



SCALE 10:1  $\left( \frac{\text{mm}}{\text{inches}} \right)$

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**

Literature Distribution Center for ON Semiconductor  
P.O. Box 61312, Phoenix, Arizona 85082-1312 USA  
Phone: 480-829-7710 or 800-344-3860 Toll Free USA/Canada  
Fax: 480-829-7709 or 800-344-3867 Toll Free USA/Canada  
Email: orderlit@onsemi.com

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada

**Japan:** ON Semiconductor, Japan Customer Focus Center  
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051  
Phone: 81-3-5773-3850

**ON Semiconductor Website:** <http://onsemi.com>

**Order Literature:** <http://www.onsemi.com/litorder>

For additional information, please contact your local Sales Representative.